

# WEST NILE VIRUS

## Overview

The West Nile virus (WNV) is a virus transmitted by mosquitoes to other animals through a mosquito bite. The virus is commonly found in Africa, West Asia, and the Middle East. It was first reported in the United States in New York State in the summer of 1999. As of October 21, 2002, it has been detected in 43 States and the District of Columbia in the United States. The geographic range of WNV detection within the United States has expanded each year.

The WNV normally cycles between mosquitoes and birds. However, if a person or animal is bitten by a WNV-infected mosquito, the virus may be transmitted to them. In the United States in 2001, thousands of wild birds, more than 700 horses, and 66 people were infected with severe cases of WNV. Severe illness due to WNV infection is rare in humans.



Jim Gathany, CDC

Most human WNV infections cause either no symptoms or a mild flu-like illness. The most severely affected patients may develop an inflammation of the brain called encephalitis. These severe cases are very rare in humans. From 1999 to 2001 in the United States, 149 cases of severe illness and 18 deaths caused by WNV were reported in humans. As of October 21, 2002, State health departments have reported 3242 cases and 176 deaths in humans to the electronic surveillance system of the Centers for Disease Control and Prevention (CDC). Persons over age 50 are at higher risk of severe illness following infection.

Workers at risk of exposure to WNV include those working outdoors when mosquitoes are actively biting. Occupations at risk include farmers, foresters, landscapers, groundskeepers, painters, roofers, pavers, construction workers, and other outdoor workers. The most likely route of WNV infection to humans is through the bite of an infected mosquito. WNV may also be transmitted by organ transplantation, blood transfusion, or breast milk [CDC 2002a\*]. No evidence exists that health care, animal husbandry, or other workers are at risk of infection from exposure to animals or humans infected with WNV. Person-to-person or animal-to-person transmission of WNV is not known to occur. In a recent study, workers in direct contact with sick geese were at increased risk of infection with WNV. Whether this was due to direct contact with the birds or to increased exposure to infected mosquitoes is unknown. No evidence exists that WNV can be transmitted from sick horses to humans. It is recommended that workers use standard infection control precautions when working with laboratory specimens or with humans or animals suspected or known to be infected with WNV. Also wear gloves if it is necessary to handle dead animals.

This Web page presents information about WNV relevant to occupational safety and health. Links to Federal agencies and other organizations providing comprehensive WNV information are also provided.

For updated information on the geographic range of WNV and the number of human cases, link to the CDC West Nile Virus Home Page:

<http://www.cdc.gov/ncidod/dvbid/westnile/>

For updated WNV information on organ transplantation and blood transfusions, link to this CDC Web site:

<http://www.cdc.gov/ncidod/dvbid/westnile/qa/transfusion.htm>

\*For the full text of these CDC references link to this Web site: Morbidity and Mortality Weekly Report October 4, 2002 / 51(39).

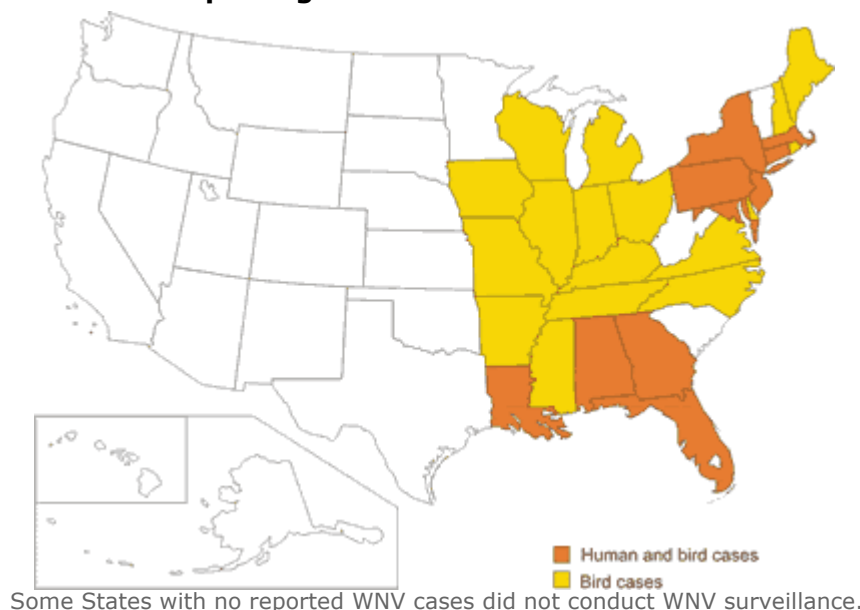
<http://www.cdc.gov/mmwr/>

# Questions and Answers

## Where is WNV found in the United States?

WNV was first reported in the United States in the summer of 1999. In 1999, nearly all cases of the disease in humans and animals were detected within a 75-mile radius of New York City. In 2000, WNV was reported in 12 States and the District of Columbia. In 2001, WNV was reported in 27 States, including much of the eastern United States. As of October 21, 2002, a total of 43 States and the District of Columbia have reported positive WNV cases.

### States reporting cases of West Nile virus in 2001



This map was developed in collaboration with and used with the permission of the Cornell University Environmental Risk Analysis Program:

<http://www.cfe.cornell.edu/erap/wnv>

For 2002 case information, link to the CDC West Nile Virus Home Page:

<http://www.cdc.gov/ncidod/dvbid/westnile/#case>

For more detailed U.S. maps of WNV cases in humans and animals, link to the U.S. Geological Survey Center for Integrated National Disaster Information Web site:

[http://cindi.usgs.gov/hazard/event/west\\_nile/west\\_nile.html](http://cindi.usgs.gov/hazard/event/west_nile/west_nile.html)

## Which working environments may increase exposure to mosquitoes?

Mosquitoes may breed in any puddle or water that stands for more than 4 days. Workers at sites near stagnant pools, ponds, watering troughs, irrigation ditches, rain barrels, manure lagoons, or any other stagnant bodies of water may be at increased risk of mosquito exposure. Equipment such as tarps, buckets, barrels, and wheel barrows may allow mosquito larvae to develop if water accumulates in them. Even water-filled ruts on the ground attract mosquitoes.

Many mosquitoes bite people most actively at dusk and dawn. When possible, avoid working outdoors when mosquitoes are biting. Some mosquitoes are active during the day—particularly in weedy, bushy, and wooded or shaded areas. When possible, avoid working in these habitats. See below for information about using personal protection when such habitats cannot be avoided.



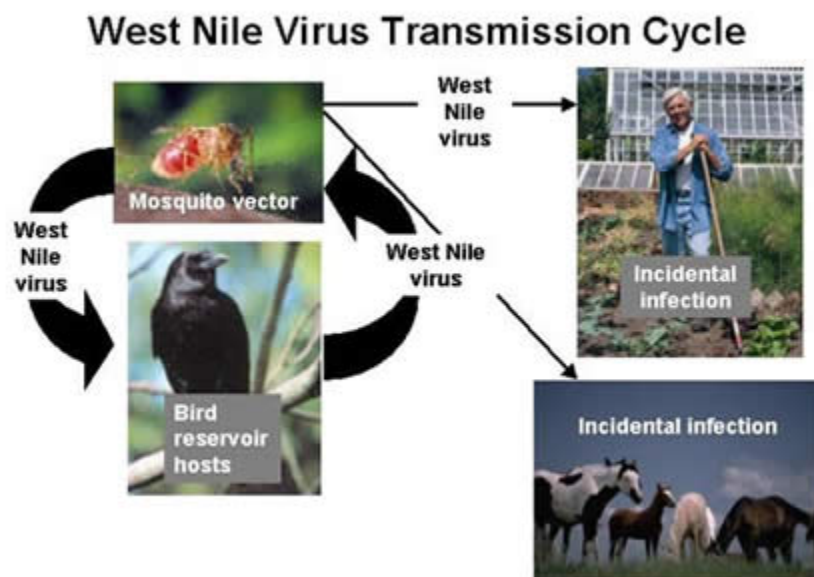
Work sites with standing water allow mosquitoes to breed.

## How can a worker be infected with WNV?

The only known way to become infected with WNV at work is through the bite of an infected mosquito. No evidence exists that health care, animal husbandry, or other workers are at risk of infection from exposure to animals or humans infected with WNV. No person-to-person or animal-to-person transmission of WNV has been known to occur. In a recent study, workers in direct contact with sick geese were at increased risk for infection with WNV. Whether this risk was due to direct contact with the birds or to increased exposure to infected mosquitoes is unknown. Use standard infection control precautions when working with laboratory specimens or humans or animals suspected or known to be infected with WNV.

Mosquitoes do not leave the WNV on surfaces they touch. The virus is transmitted through the bite of an infected mosquito.

Ticks can be infected with WNV in Asia and Africa, but it is unknown whether they transmit the virus to humans or other animals. No evidence indicates that ticks are involved in the transmission of WNV in the United States.

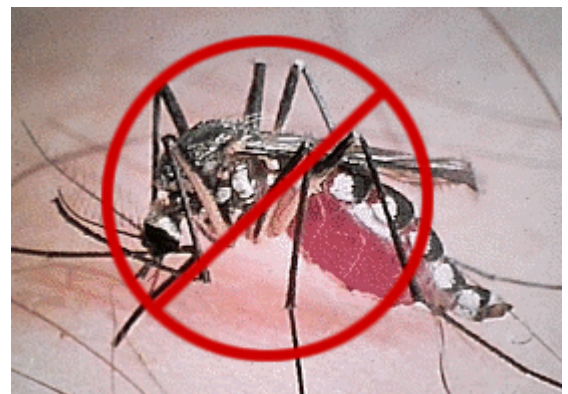


The WNV normally cycles between mosquitoes and birds. However, if a person or animal is bitten by a WNV-infected mosquito, the virus may be transmitted to them. Flow chart courtesy CDC.

## How can workers be protected from WNV infection?

### Recommendations for employers

Employers can help protect outdoor workers by implementing the environmental control measures listed below. These controls are recommended regardless of other controls that may be in place, such as local integrated vector management programs. Information about exposure to insecticides can be found at the links below.



Avoid being bitten by mosquitoes to protect against WNV infection.

- When possible, schedule work to avoid having workers outdoors when mosquitoes are most active and biting.
- Eliminate as many sources of standing water as possible to eliminate mosquito breeding areas. Take the following steps to decrease mosquito populations:
  - Prevent stagnant water in animal drinking troughs, ponds, and other standing bodies of water by changing the water every few days or aerating it.
  - Turn over, cover, or remove equipment such as tarps, buckets, barrels, and wheel barrows that accumulate water.
  - Discard tires, buckets, cans, and containers in the area.
  - Place drain holes in containers that cannot be discarded.
  - Clean out rain gutters and ditches to get rid of standing water.
  - Fill in ruts and other areas that accumulate water.

## Recommendations for workers

Outdoor workers can decrease their risk of WNV infection by reducing their contact with mosquitoes through the use of the personal protective measures listed below. Information about exposures to insecticides can be found at the links below.

- Workers should take the following steps when working at sites where mosquitoes may be actively biting:
  - Wear long-sleeved shirts, long pants, and socks when possible.
  - Spray exposed skin with insect repellents.
    - READ AND FOLLOW LABEL DIRECTIONS FOR REPELLENT USE.
    - Use repellents at the lowest effective concentration.
    - Use DEET (N-N-diethyl-3-methylbenzamide or N,N-diethylmetatoluamide) at concentrations of 35% or less.
    - Do not apply repellents to cuts, wounds, or irritated skin.
    - When needed, reapply repellents according to label directions.
  - Spray clothing with products containing DEET or permethrin, as mosquitoes may bite through thin clothing.
    - Wash treated clothing before wearing it again.
    - Do not apply repellents under clothing.
- Follow standard infection control procedures when handling sick or dead animals or laboratory specimens to minimize the risk of infectious disease.

For more recommendations for outdoor workers, link to the New York State Department of Health fact sheet for outdoor workers:

<http://www.health.state.ny.us/nysdoh/pest/wnvoutdr.htm>

For more information about insect repellents, link to these U.S. EPA Web sites:

U.S. EPA: How to Use Insect Repellents Safely

<http://www.epa.gov/pesticides/citizens/insectrp.htm>

U.S. EPA: Recognition and Management of Pesticide Poisonings

<http://www.epa.gov/oppfead1/safety/healthcare/handbook/handbook.htm>

The National Pesticide Information Center (NPIC) can be contacted by telephone at 1-800-858-PEST (1-800-858-7378), 9:30 a.m. to 7:30 p.m. eastern standard time, 7 days/week, or link to the NPIC Web site:

<http://npic.orst.edu>

## **What precautions should workers take to minimize exposure to blood and other tissues from WNV-infected humans or animals?**

An infection with WNV is most likely acquired through the bite of an infected mosquito. Individuals are not at risk from WNV infection through normal contact with WNV infected persons or animals. An ongoing interagency investigation has determined, however, that WNV may be transmitted through blood transfusion or organ transplantation [CDC 2000b]<sup>†</sup>. Until further studies determine whether workers are at risk of WNV infection from exposure to blood or tissues from WNV-infected human or animal cases, it is prudent public health practice to minimize contact with these tissues. Many occupations are at potential risk of exposure to WNV-infected humans, animals, or their blood or other tissues. Occupations at risk include health care workers, emergency response and public safety personnel, public health employees, ornithologists, wildlife biologists, pathologists, laboratory researchers, and related occupations. Some of these occupations routinely use universal precautions against blood-borne pathogens. The following recommendations are intended for the laboratory and field workplaces. These are minimal recommendations to reduce exposure to blood and other tissues from WNV-infected cases. More stringent protective equipment and work practices should be used when warranted.

### **The following are recommendations for workers exposed to blood or tissues of humans or animals potentially infected with WNV:**

- Use available engineering controls and work practices to prevent exposure to blood and other tissues.
- Use barriers including gloves, gowns, safety glasses, and/or face shields to avoid dermal and mucous membrane contact with blood and other tissues.
- Wash hands and other skin surfaces immediately after contact with blood or other tissues.
- Handle sharp instruments carefully during use.
- Use medical devices with safety features when available to avoid sharps-related injuries.
- Avoid recapping needles.
- Dispose of sharp instruments carefully after use.
- Report all needlestick and other sharps-related injuries.
- Report any symptoms consistent with WNV infection.

<sup>†</sup>For the full text of the update on WNV in organ transplantation and blood transfusions, link to this CDC Web site:

Morbidity and Mortality Weekly Report September 27, 2002 / 51 (CDC Advisory);1-2.

[http://www.cdc.gov/mmwr/preview/mmwrhtml/advisory\\_westnile.htm](http://www.cdc.gov/mmwr/preview/mmwrhtml/advisory_westnile.htm)

### **For more information on bloodborne pathogens and needlestick prevention, link to these Web sites:**

NIOSH Topic Page on Bloodborne Infectious Diseases

<http://www.cdc.gov/niosh/topics/bbp/>

CDC/NCIDOD Topic Page on Bloodborne Pathogens Worker Protection

<http://www.cdc.gov/ncidod/hip/BLOOD/worker.htm>

OSHA Topic Page on Needlestick Prevention

<http://www.osha-slc.gov/SLTC/needlestick/index.html>

NIOSH Topic Page on Emergency Needlestick Information

<http://www.cdc.gov/niosh/topics/bbp/emrgnedl.html>



## What are the signs and symptoms of WNV infection in humans?

Most people who have been infected with WNV never have any symptoms of the disease. Estimates from a study conducted in New York City following the 1999 outbreak indicated that fewer than 1% of WNV infections resulted in severe neurological disease [Mostashari et al. 2001, *The Lancet*, 358:261-264\*]. Most people with evidence of WNV infection either had no symptoms or had mild symptoms, including fever, fatigue, headache, and muscle or joint pain. Signs of severe infection include high fever, stiff neck, disorientation, tremors, muscle weakness, and paralysis. A small number of cases have been fatal. The time of incubation from mosquito bite to clinical symptoms varies, but it is reported to be from 3 to 15 days.

Severe disease due to WNV infection is rare in humans. From 1999 to 2001 in the United States, 149 cases of severe illness due to WNV and 18 deaths were reported in humans to CDC's electronic surveillance system. As of October 21, 2002, State health departments have reported 3242 cases and 176 deaths in humans. The incidence of severe disease is highest among persons over age 50.

\*For the full text of this reference and other references, link to the Cornell Environmental Risk Analysis Program Bibliography of Scientific Literature:  
[http://www.cfe.cornell.edu/erap/WNV/WNVSciRefs\(A-B\).cfm](http://www.cfe.cornell.edu/erap/WNV/WNVSciRefs(A-B).cfm)

## What should a worker do who suspects he or she has been infected with WNV?

Any worker who has health concerns should contact his or her health care provider. If the worker is at risk of WNV infection and shows signs of WNV infection, a blood sample may be sent to a laboratory for testing. No specific treatment exists for WNV infection. Treatment consists of supportive care for the individual. In severe cases this may involve support of the circulatory, respiratory, renal, and other vital systems. Currently, no approved vaccine exists to prevent WNV infection in humans.



Images courtesy of the Ohio State University Veterinary Preventive Medicine Web site, West Nile Virus page.

<http://prevmed.vet.ohio-state.edu/new/Extension/WestNile/WNV.htm>

## How is WNV tracked in the United States?

Local, State, and Federal agencies are working together to track the geographic location of WNV in the United States. The CDC is collaborating with state and local health departments and the U.S. Geological Survey to collect data on WNV in mosquitoes, birds, horses, other animals, and humans throughout the United States. Tracking the presence of the virus is important in planning the prevention and control of WNV infections from mosquitoes to humans. The investigation of deaths in wild birds, particularly in crows, blue jays, and other members of the corvidae family and raptors provides an assessment of the geographic location of WNV. The public plays an important role in tracking the virus by reporting dead birds and sick horses. A worker who finds a dead bird should notify his or her supervisor or local health department. Be sure to wear gloves if it is necessary to handle dead animals.

This U.S. Geological Survey link displays detailed U.S. surveillance maps of bird, mosquito, veterinary, and human WNV cases:

[http://cindi.usgs.gov/hazard/event/west\\_nile/west\\_nile.html](http://cindi.usgs.gov/hazard/event/west_nile/west_nile.html)

# Links to other Sites with WNV Information

## U.S. Government Web sites

CDC West Nile Virus Home Page

<http://www.cdc.gov/ncidod/dvbid/westnile>

CDC Morbidity and Mortality Weekly Reports, West Nile virus articles

<http://www.cdc.gov/mmwr>

CDC Public Health Image Library, West Nile virus mosquito photographs

<http://phil.cdc.gov/Phil>

U.S. Department of Agriculture Animal and Plant Health Inspection Service, West Nile Virus Site

<http://www.aphis.usda.gov/oa/wnv>

U.S. Geological Survey National Wildlife Health Center, West Nile Virus Site

[http://www.nwhc.usgs.gov/research/west\\_nile/west\\_nile.html](http://www.nwhc.usgs.gov/research/west_nile/west_nile.html)

National Institutes of Health, West Nile Virus Site

<http://www.nih.gov/news/westnile.htm>

Food and Drug Administration, West Nile Virus Site

<http://www.fda.gov/oc/opacom/hottopics/westnile.html>

## State and Local Government Web sites

State and Local Government Web site links on the CDC West Nile Virus Home Page

<http://www.cdc.gov/ncidod/dvbid/westnile>

## Other Web sites

Cornell University Environmental Risk Analysis Program, WNV Section

<http://www.cfe.cornell.edu/erap/wnv>

Annals of the New York Academy of Sciences, Volume 951.

West Nile Virus: Detection, Surveillance and Control

<http://www.annalsnyas.org/content/vol951/issue1/>

National Library of Medicine, Medlineplus West Nile Virus Site

<http://www.nlm.nih.gov/medlineplus/westnilevirus.html>

International Society for Infectious Diseases, ProMED-mail

<http://www.promedmail.org>

National Pesticide Information Center Web Site, West Nile Virus Resource Guide

<http://npic.orst.edu/wnv>

## Related NIOSH publications

NIOSH Alert: Preventing Needlestick Injuries

DHHS (NIOSH) Pub No. 2000-108 November 1999

<http://www.cdc.gov/niosh/2000-108.html>

NIOSH Brochure: How to Protect Yourself From Needlestick Injuries

DHHS (NIOSH) Pub No. 2000-135

<http://www.cdc.gov/niosh/2000-135.html>

Working in Hot Environments, DHHS (NIOSH) Publication No. 86-112

<http://www.cdc.gov/niosh/hotenvt.html>

NIOSH Alert: Asthma in Animal Handlers, DHHS (NIOSH) Publication No. 97-116

<http://www.cdc.gov/niosh/animalrt.html>